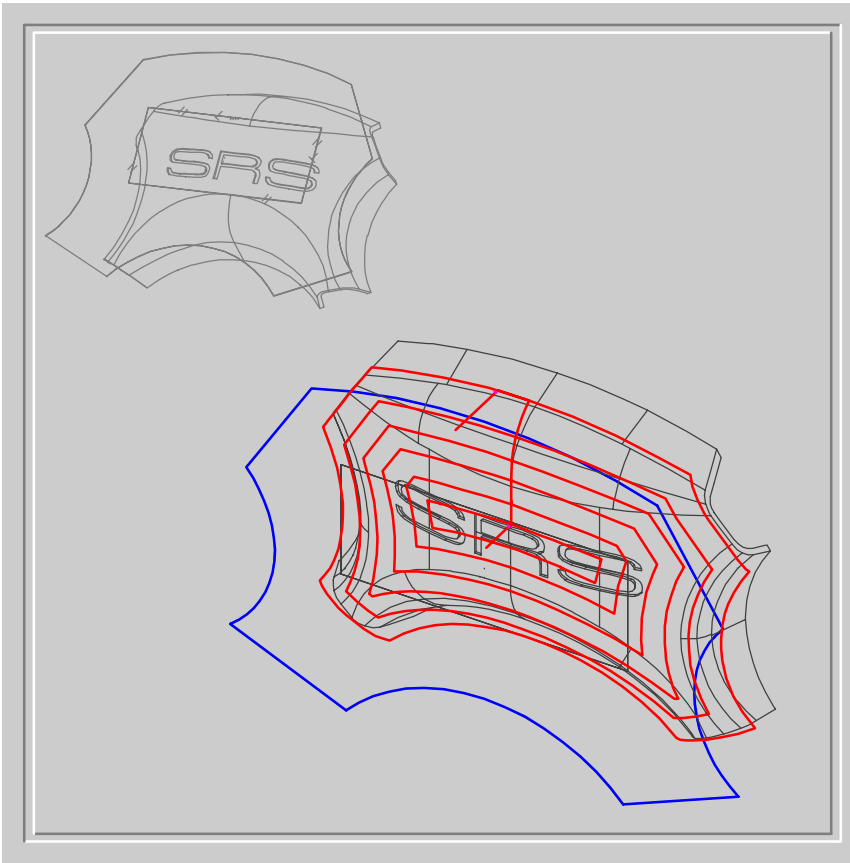


Creating Copy Mill Operations

I-DEAS™ Tutorials: Milling Projects

Copy mill is a 3-axis milling operation used to create surface finish passes. This operation produces toolpaths similar to those from a copy mill machine.

In this tutorial, you'll learn how to control the cutting passes with constant step and constant cusp parameters. You'll also learn how to constrain the passes by picking bounding sections.

Learn how to:

- specify a constant step
- specify a constant cusp
- constrain cutting passes

Before you begin...

Prerequisite tutorials:

- all tutorials under the Modeling Fundamentals menu
- Introduction to Generative Machining
- Building a Setup Assembly
- Generating In-process Stock and Checking Validity
- Working with Tools and Tool Catalogs
- Picking Holes
- Setting Machining Parameters for Hole-making Operations

The file you need for this tutorial is distributed with the product. You must copy it into your local directory.

Move to the local directory where you want to copy the file. Then:

In UNIX:

```
cp $SDRC_INSTL/examples/nc/tut_copymill.arc .
```

In Windows use:

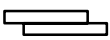
```
copy %SDRC_INSTL%\examples\nc\
tut_copymill.arc .
```

If you can't copy the file, you may have to set up the variable needed to copy from the I–DEAS installation.

```
. sdrc_oadev
```

If you can't access the file, contact your system administrator. The file may not be installed.

If you didn't start I-DEAS with a new (empty) model file, open a new one now and give it a unique name.


File
Open


Model File Name: any unique name

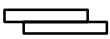

OK

Make sure you're in the following application and task:


Application: Manufacturing


Task: Generative Machining

Set your units to Inch (pound f)


Options,
Units


Inch (pound f)

Import the archive file that contains the parts and tools that you need to complete this tutorial. Importing an archive file can take several minutes. Be patient.

File
Import

Import Selections form


I–DEAS Archive File
OK

File Name Input form

Archive file name: tut_copymill.arc
OK

The Manufacturing application quits, an informational message is displayed (the message will dismiss automatically), and the archive file is imported.

Import Archive File Status

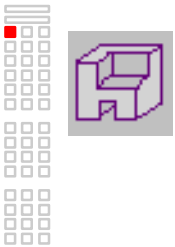

Check *I-DEAS List*.

Be sure to check the List region to be sure that the parts imported properly.

Dismiss

A second informational message is displayed (the message will dismiss automatically) and the Manufacturing application starts.

Create a job.



NC Job Create form

Job Name: Air Bag Job

OK

Add the part to the job.

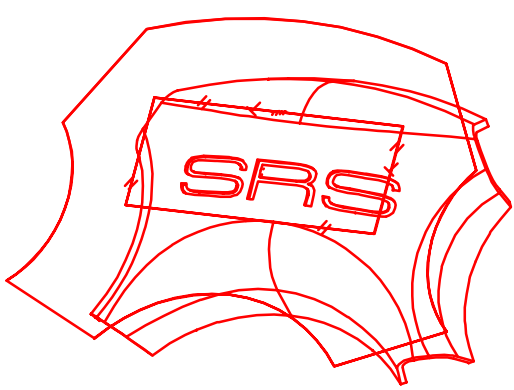
Get

From Bin/Library

Select Part/Assembly form

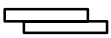
tut_air_bag_cover

OK



The part is located relative to the global-space coordinate system with the origin at the center of the workplane. You can view the global-space coordinate system by picking *Workplane Appearance...,* then toggling on *Display Origin* on the *Workplane Attributes* form.

Recovery Point


File
Save

Warning!
If you're prompted by I-DEAS to save your model file, respond:


No

Save only when the tutorial instructions tell you to—not when I-DEAS prompts for a save.

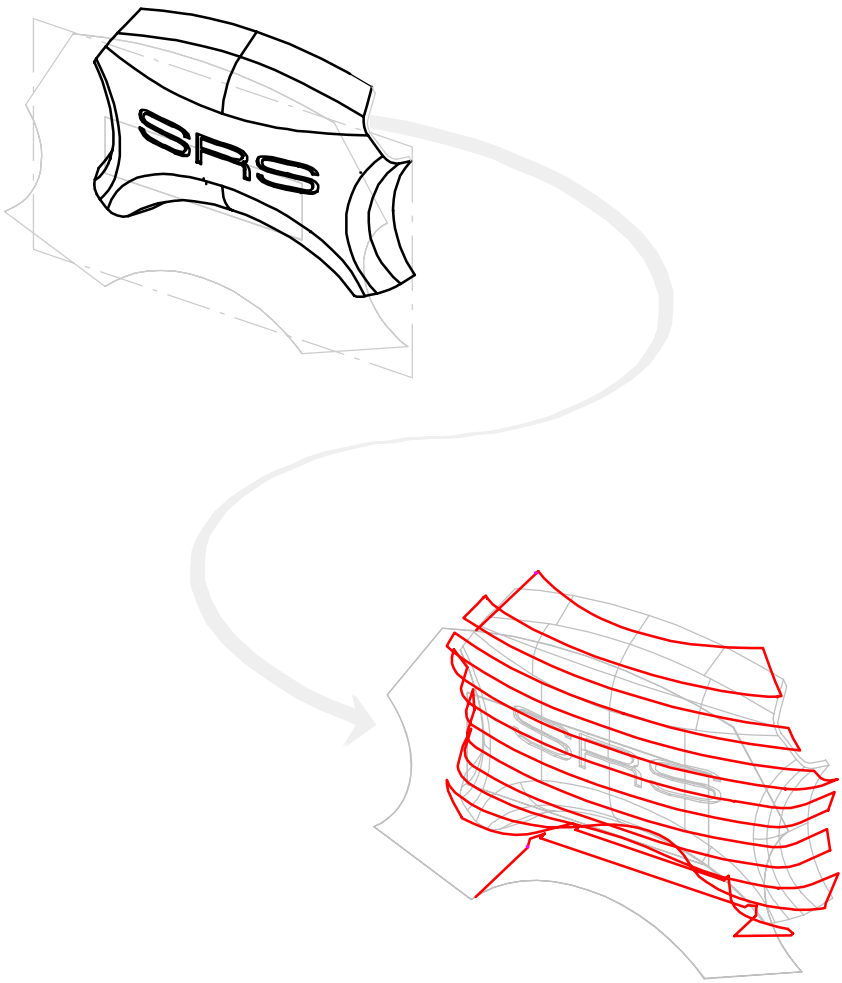
If you make a mistake at any time between saves and cannot recover, reopen your model file to the last save and start over from that point.

Hint
To reopen your model file to the previous save, press Control-Z.

Specify a constant step

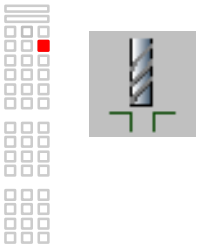
In the next steps, you'll create a copy mill operation to machine the front surface of the air bag. You'll set the distance between the passes by specifying a constant step.

You also learn a new technique for selecting multiple surfaces based on the tangency of one surface to the next.



What: Create a copy mill operation.

How:



Operation Selection form

Category: Milling

Type: Copy Mill

Create

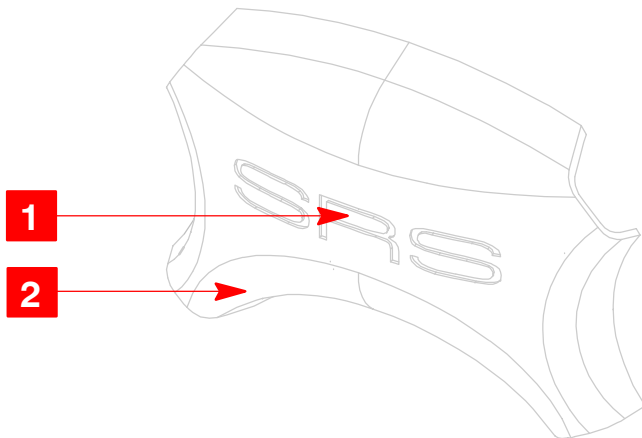
Don’t close the Operation Specification form.

What: Pick the surfaces composing the front of the part.

How:

Operation Specification form

1. pick the island surface inside the R, F148
2. pick any other surface on the face of the part



 *Selection Options*

 *Tan Chain Selected*

Things to notice All surfaces on the front face of the part are selected.

 *Done*

Surface Selection form

 *Dismiss*

 Don’t close the Operation Specification form.

What: Use a 1” bull nose end mill to machine the surfaces.

How:

Operation Specification form

Cutting Tool Specification—Mill form

Find...

Item Selection form

1” bull nose end mill

OK

Cutting Tool Specification—Mill form

OK

Don’t close the Operation Specification form.

What: Define the cut parameters and set the allowance and tolerances for the operation. You define the step between each pass as 60 percent of the tool diameter.

Default finish allowance is the amount of stock to be left on the machined surfaces. *Intol* and *Outol* are the maximum amount of material that the tool can gouge or leave behind while approximating the toolpath.

How:

Operation Specification form

Machining Parameters: Cut form

 *Constant Stepover*: 25

 *Cut*

Allowances and Tolerances...

Machining Parameters: Allowances/Tolerances

 *Default Finish*: 0.01

 *Intol*: 0.005

 *Outol*: 0.005

 *Allowances and Tolerances...*

Connection...

Machining Paramters: Connections form

 *Use Straight Line if Void is Less Than*: *7*

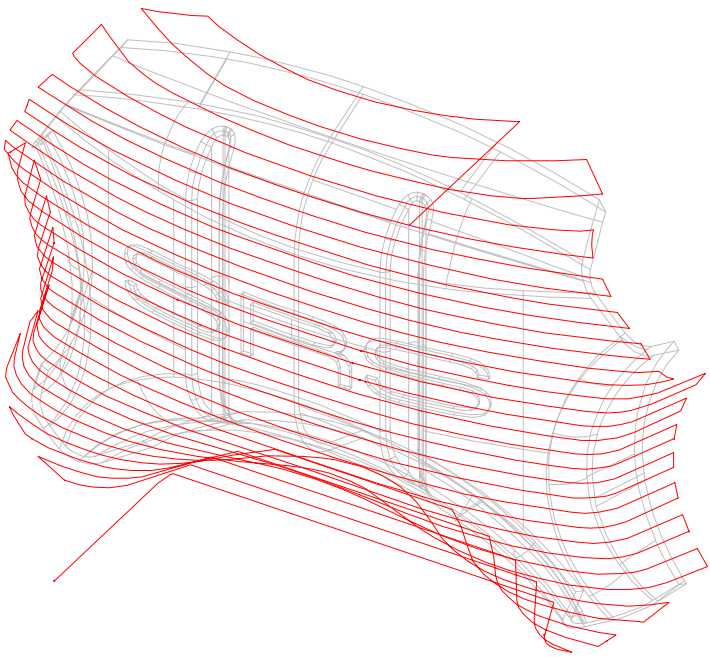
 *OK*

Don’t close the Operation Specification form.

What: Generate the toolpath.

How:

Operation Specification form



Things to notice

The tool cuts in a zig-zag cut pattern and doesn't retract until the surface is machined. Also, notice the even distance between the cuts.

Recovery Point

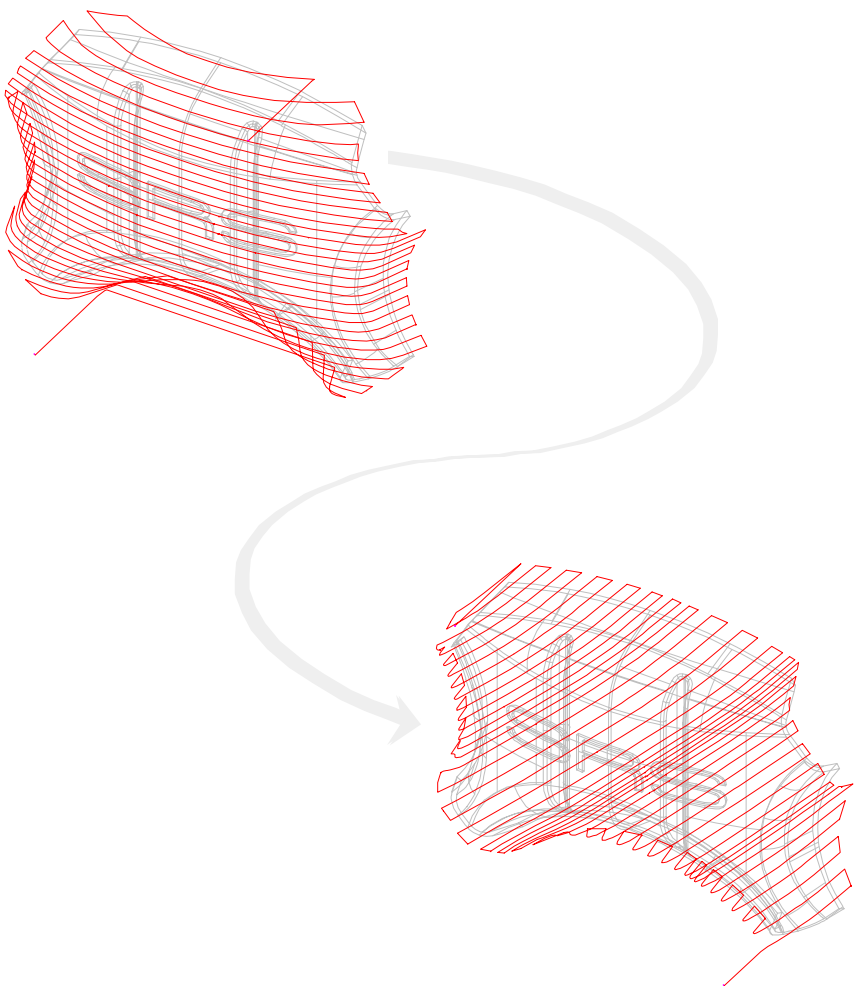
File
Save

Specify a constant cusp

In the next steps, you'll modify the copy mill operation. You'll change the method for calculating the distance between the passes from constant step to constant cusp. *Constant Cusp* ensures a cusp height between the successive cuts less than or equal to the value you set. The cusp height is measured in relation to the surface being machined.

You can use *Constant Cusp* for surfaces with a smooth transition between surfaces. If the tangents of the surfaces vary too much in relation to the tool size, however, the calculation of the cusps might be inconsistent.

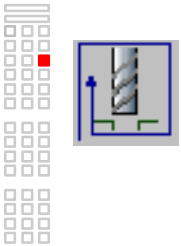
You'll also learn how to change the angle of the cutting passes.



What: Define the cusp height as .05 inches. Then set the maximum distance between the cuts as 50 percent of the tool diameter. When the step is calculated for the specified cusp height, it won't exceed this distance.

Change the angle of the cuts to 45 degrees.

How:



Operation Specification form

Machining Parameters: Connections form

 *Allowances and Tolerances...*
Cut...

Machining Parameters: Cut form

 *Cut Angle*: 45

 *Constant Cusp*: 0.05

 *Step Limits...*

Step Limits form

 *Maximum Step*: 50

 *OK*

 *OK*

Don't close the Operation Specification form.

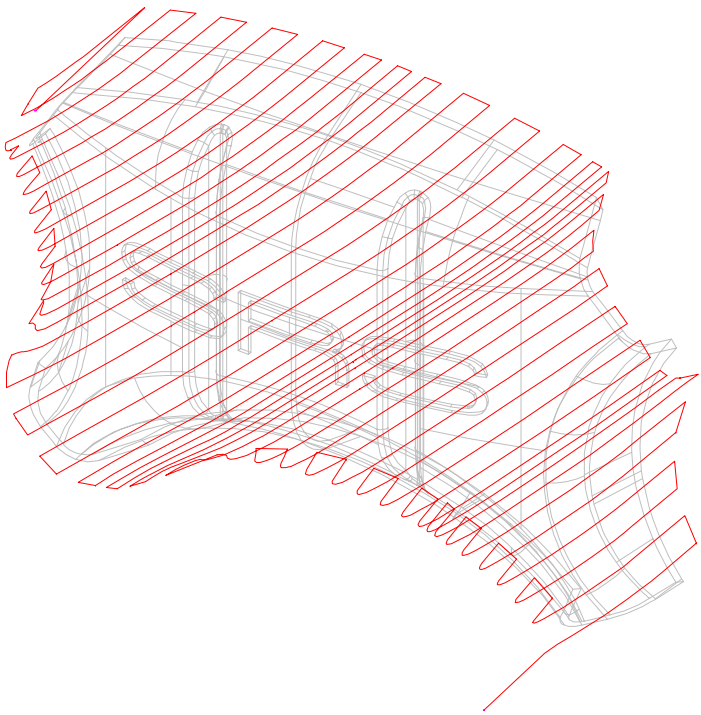
What: Generate the toolpath. You may need to reverse the step direction to generate the complete toolpath.

How:

Operation Specification form

I-DEAS Warning

OK



Things to notice The angle of the cut is at 45 degrees and the distance between the stepovers has changed to create the even cusps. To maintain the constant cusp where the cut stoke is close to parallel with a vertical surface, the stepover distance is reduced.

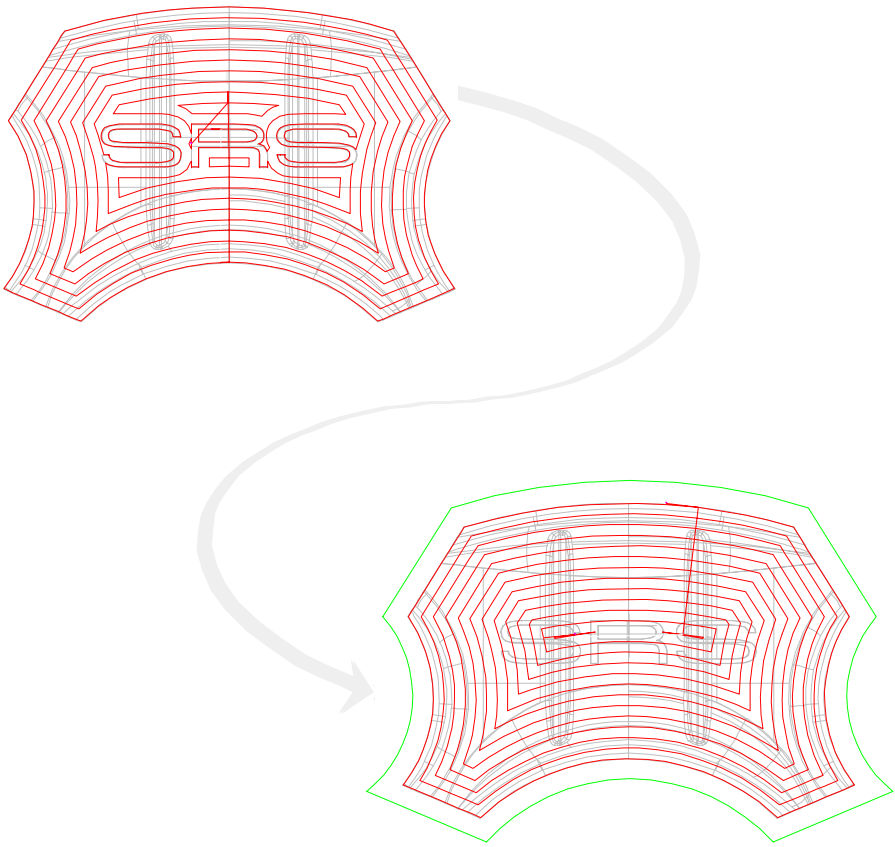
Recovery Point

File
Save

You can constrain or limit the area to be machined on a part by using a boundary. A machining boundary can be specified by either a section you created in the modeling task or the silhouette of each set of contiguous cut surfaces. Multiple sets of contiguous cut surfaces result in multiple cut regions and boundaries.

You can use machining boundaries to create different finishes on a surface or to clean up a region untouched by a large tool.

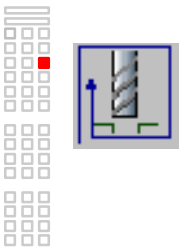
In the next steps, you'll first generate the toolpath without picking a bounding section. The software uses the silhouette of contiguous cut surfaces as the default behavior. You will then modify the operation to use a boundary section.



What: Set the distance between the cuts as a constant step of 60 percent of the tool diameter. Then set the cut pattern to *Spiral In*.

Select *Linear Tangential* as the type of entry. *Linear Tangential* moves the tool from the engage plane and enters tangent to the first cut motion of the toolpath.

How:



Operation Specification form

Machining Parameters: Cut form

 *Constant Stepover*

 *Cut Pattern*

 *Cut...*

Entry...

Machining Parameters: Entry form

 *Entry Type*: *Plunge*

 *OK*

Don’t close the Operation Specification form.

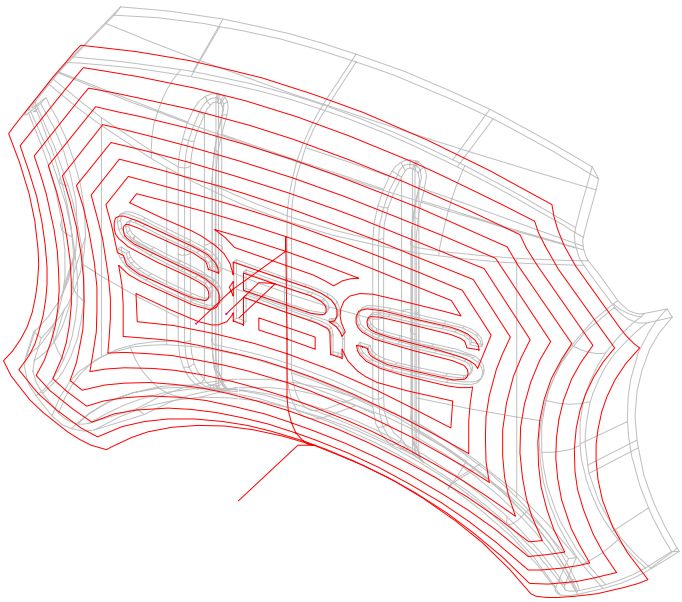
What: Generate the toolpath.

How:

Operation Specification form

I-DEAS Warning

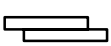
 *OK*



Things to notice

Because the lettering channels are not part of the contiguous cut surfaces, they are avoided when the toolpath is generated. The software also sees the island inside the letter R as a separate region and generates a second toolpath pattern.

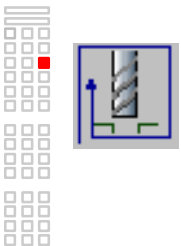
Recovery Point

 *File*
Save

What: Modify the operation and pick the outer bounding section.

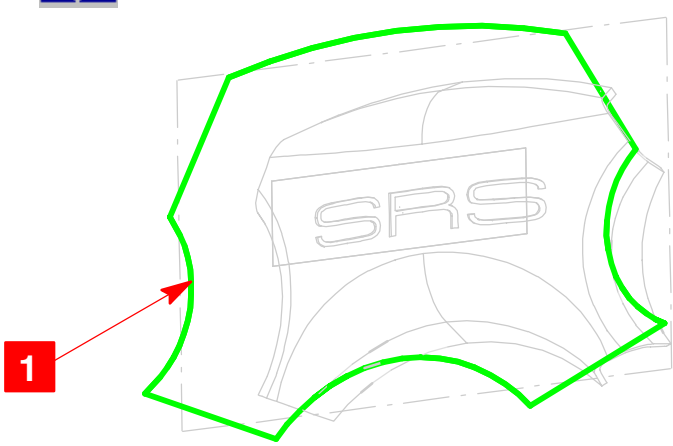
When building a bounding section, you can use the edges of the part. Depending on your model, you'll probably want to offset the section from the selected surfaces.

How:



Operation Specification form

Containment Options form



OK

Don't close the Operation Specification form.

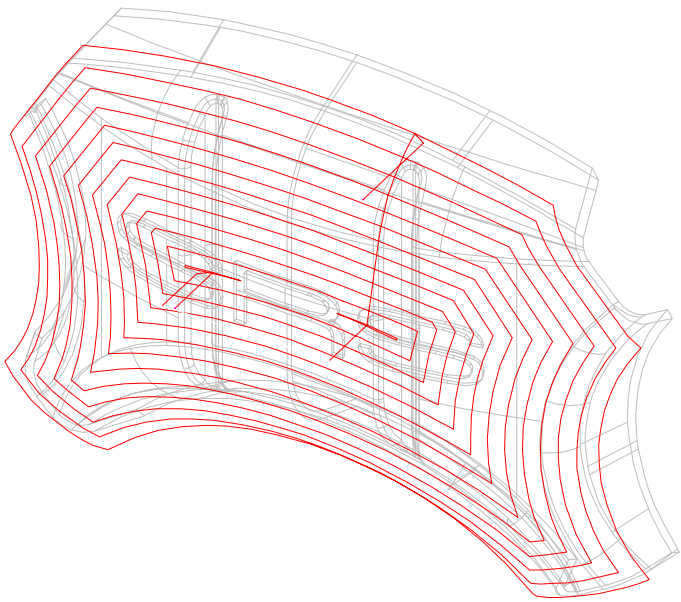
What: Reprocess the toolpath.

How:

Operation Specification form

I-DEAS Warning

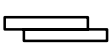
 *OK*



Things to notice

The toolpath stays within the boundaries of the section while maintaining the spiral cut pattern. Also, notice that you don't have any unnecessary moves over the letter channel portions of the part because of the shape of the section.

Recovery Point

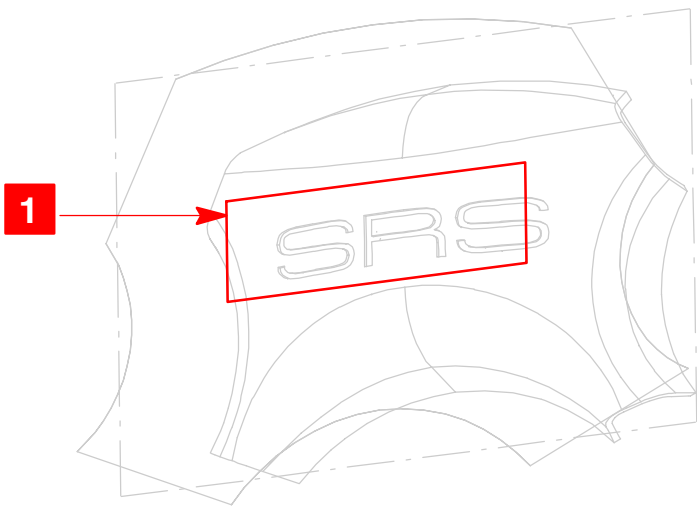
 *File*
Save

On your own...

What: Create another copy mill operation to machine over the letters SRS. For this operation, you'll use the rectangular bounding section to contain the toolpath.

How: Use the following parameters. The surfaces should be selected from the previous operation.

Pick the bounding section



On your own...

Create a .25” ball mill

Identifier: .25” Ball Nose Ball Mill

Style: *Ball Mill*

Holder Diameter: 1

Shank Diameter: .5

Holder to Tip Dist: 2

Max Depth of Cut: 1

Cutter Diameter: .25

Specify the cut parameters

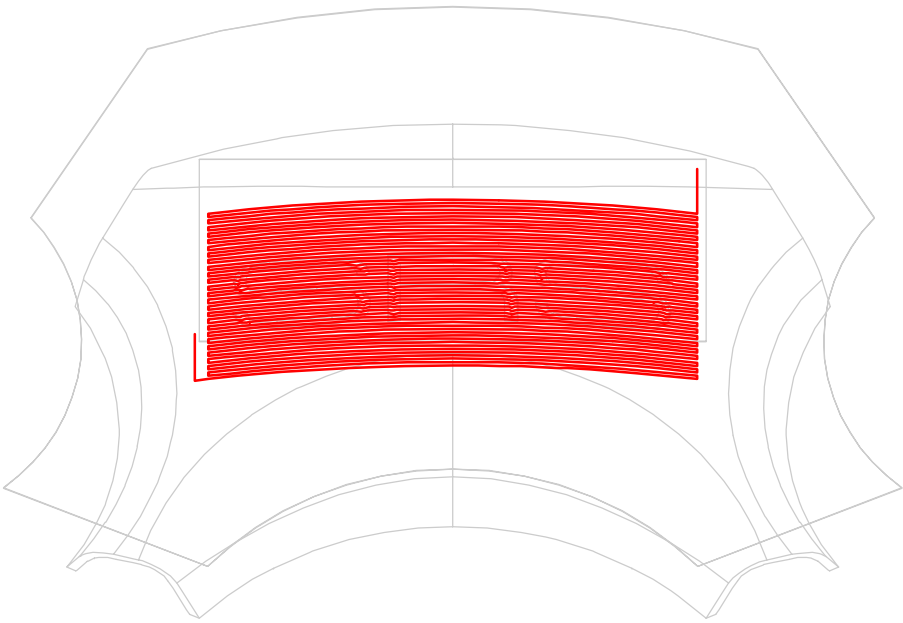
Constant Stepover: 20

Cut Angle: 0

Cut Type
Bi-Directional

On your own...

Generate the toolpath.



Things to notice

The toolpath stays within the boundaries of the section to machine only the region around the letters. Also, notice the zig-zag pattern that you set in the machining parameters.

Recovery Point

File
Save

Tutorial wrap-up

You've completed the Creating Copy Mill Operations tutorial.